SIXTH GRADE MATHEMATICS

GRADE LEVEL CONTENT EXPECTATIONS

6 MATH

v.4.04

NUMBER & OPERATIONS

ALGEBRA

MEASUREMENT

GEOMETRY

DATA & PROBABILITY

Welcome to a preview of Michigan's mathematical future! This document not only introduces Michigan's new Grade Level Content Expectations for mathematics, it also establishes high expectations in mathematics to better prepare all K-12 Michigan students for the challenges of the future.

Creating grade-level expectations involves a complex combination of understanding of mathematics, curriculum, student learning, teaching, current practices, and policy. Curriculum directors, mathematics educators, and classroom teachers from Michigan school districts across the state, together with mathematics and mathematics education faculty from universities across the state, have been involved in the development and/or review of the **Michigan Mathematics Grade Level Content Expectations.** The GLCE are intended to be usable as a framework for the development of grade-by-grade assessments, and to provide teachers with a guide for their instructional and curricular emphases in classrooms. The expectations were constructed to feature continuity from one grade to the next, and to ensure coherence both mathematically and pedagogically. These expectations represent a challenge toward which to aspire; in some cases, teachers and mathematics educators will be called on to move beyond their current practice and experience into territory that will be both demanding and rewarding. Michigan students can rise to the challenge of high academic standards. This document provides a set of ambitious goals for all of us.

This document is intended to be an assessment tool. This means students will be expected to be proficient in the concepts and skills included in this document at the end of the indicated grade level. These expectations are written to convey intended performances by students. The expectations here generally represent key landmarks in mathematics learning — areas where students are expected to have consolidated their understandings and skills. Thus it does not attempt to elaborate all of the precursor ideas and concepts that lead to a particular expectation in a particular grade level — it instead assumes that teachers will build up to the expectations through exploration and development of concepts and processes

The Grade Level Content Expectations are not designed to be a curriculum document, or to function as a scope and sequence framework. It is not designed to suggest the various pedagogical options and strategies that might best enable students to attain these expectations. Rather, it should serve as a basis for the development of a curriculum and instructional strategies that would help the students attain the concepts and skills necessary to meet the GLCE. Various groups are being organized

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to develop clarification documents, content examples, more elaborated explanations, and suggestions for professional development that would support these expectations. Ultimately, teachers, school personnel and district leaders will need to collaborate and draw on their own professional wisdom and experience, as well as on research, to decide how best to organize instruction to help their students meet these expectations.

The mathematics content expectations have been organized into five strands: Number and Operations, Algebra, Geometry, Measurement, and Data and Probability.

These expectations are being presented in two formats; one designed to show specific grade level expectations and a second to show how the expectations transition from one grade level to the next. In the **grade level** format the expectations are organized first by the five strands. Each of the strands is then broken down into content pieces titled "Topics" in an attempt to cluster related ideas for teaching continuity. Under each "Topic" are listed the expectations.

The second format is a "**cross-grade**" version, which has been designed with the intent that one grade level can be easily compared with another and to highlight the mathematical growth that is envisioned across the grades. This format also has been organized into the five strands. However, each strand has been subdivided into broader, more conceptual groupings called "Domains," to allow for cross grade comparison of the expectations. In several of the strands, the "domains" are similar to the "standards" in *Principles and Standards for School Mathematics* from the National Council of Teachers of Mathematics. In the "cross-grade" version, some key expectations are "cross-listed" in grey when they seem especially crucial to the development of another strand. For instance, several strands from the Number and Operations strand are also listed in grey in the Algebra strand.

Although this organization does not include what have typically been called "process" strands, the importance of mathematical process in the development of these proficiencies cannot be underestimated. Embedded within these expectations are emphases on representation, problem solving, and reasoning as appropriate. The importance of making mathematical connections is conveyed through the cross listing. Finally, the process of communication is foundational to all of mathematics learning.

With the cooperation of all those involved in the education of Michigan students, we can enable our young people to attain the highest standards – and thereby open doors for them to have fulfilling and successful lives in a quantitatively and technologically complex future.

SIXTH GRADE

Work with number is essentially completed by the end of sixth grade, where students' knowledge of whole numbers and fractions (ratios of whole numbers with non-zero denominators) should be introduced to integers and rational numbers. All of the number emphasis is intended to lay a foundation for the algebra expectations that are included in grade six. Students should use variables, write simple expressions and equations, and graph linear relationships. In geometry, students continue to expand their repertoire about shapes and their properties.

NUMBER AND OPERATIONS

Multiply and divide fractions

N.MR.06.01 Understand division of fractions as the inverse of multiplication, e.g., if $\frac{4}{5} \div \frac{2}{3} = \square$, then $\frac{2}{3} \times \square = \frac{4}{5}$, so $\square = \frac{4}{5} \cdot \frac{3}{2} = \frac{12}{10}$.

N.FL.06.02 Given an applied situation involving dividing fractions, write a mathematical statement to represent the situation.

N.MR.06.03 Solve for the unknown in equations such as: $\frac{1}{4} \div \square = 1\frac{3}{4} \div \square = \frac{1}{4}$ and $\frac{1}{2} = 1 \cdot \square$.

N.FL.06.04 Multiply and divide any two fractions, including mixed numbers, fluently.

Represent rational numbers as fractions or decimals

N.ME.06.05 Order rational numbers and place them on the number line.

N.ME.06.06 Represent rational numbers as fractions or terminating decimals when possible, and translate between these representations.

N.ME.06.07 Understand that a fraction or a negative fraction is a quotient of two integers, e.g., $-\frac{8}{3}$ is -8 divided by 3.

Add and subtract integers and rational numbers

N.MR.06.08 Understand integer subtraction as the inverse of integer addition; add and subtract integers using integers from 10 to -10.

N.FL.06.09 Add, subtract, multiply, and divide integers between -10 and 10; use number line and strip models for addition and subtraction.

N.FL.06.10 Add, subtract, multiply and divide positive rational numbers fluently.

Find equivalent ratios

N.ME.06.11 Find equivalent ratios by scaling up or scaling down.

Solve decimal, percentage and rational number problems

N.FL.06.12 Calculate part of a number given the percentage and the number.

N.FL.06.13 Solve word problems involving percentages in such contexts as sales taxes and tips, and involving positive rational numbers.

N.FL.06.14 For applied situations, estimate the answers to calculations involving operations with rational numbers.

N.FL.06.15 Solve applied problems that use the four operations with appropriate decimal numbers.

Use exponents

N.ME.06.16 Understand and use integer exponents, excluding powers of negative numbers; express numbers in scientific notation.

Understand rational numbers and their location on the number line

N.ME.06.17 Locate negative rational numbers (including integers) on the number line; know that numbers and their negatives add to 0, and are on opposite sides and at equal distance from 0 on a number line.

N.ME.06.18 Understand that rational numbers are quotients of integers (non-zero denominators), e.g., a rational number is either a fraction or a negative fraction.

N.ME.06.19 Understand that 0 is an integer that is neither negative nor positive.

N.ME.06.20 Know that the absolute value of a number is the value of the number, ignoring the sign, or is the distance of the number from 0.

ALGEBRA

Calculate rates

A.PA.06.01 Solve applied problems involving rates including speed, e.g., if a car is going 50 mph, how far will it go in $3\frac{1}{2}$ hours?

Understand the coordinate plane

A.RP.06.02 Plot ordered pairs of integers and use ordered pairs of integers to identify points in all four quadrants of the coordinate plane.

Use variables, write expressions and equations, and combine like terms

A.FO.06.03 Use letters, with units, to represent quantities in a variety of contexts, e.g., y lbs., k minutes, x cookies.

A.FO.06.04 Distinguish between an algebraic expression and an equation.

A.FO.06.05 Use standard conventions for writing algebraic expressions, e.g., $2x + 1$ means "two times x, plus 1" and $2(x + 1)$ means "two times the quantity $(x + 1)$."

A.FO.06.06 Represent information given in words using algebraic expressions and equations.

A.FO.06.07 Simplify expressions of the first degree by combining like terms, and evaluate using specific values.

Represent linear functions using tables, equations, and graphs

A.RP.06.08 Understand that relationships between quantities can be suggested by graphs and tables.

A.PA.06.09 Graph and write equations for linear functions of the form $y = mx$, and solve related problems, e.g., given n chairs, the "leg function" is $f(n) = 4n$; if you have 5 chairs, how many legs?; if you have 12 legs, how many chairs?

A.RP.06.10 Represent simple relationships between quantities, e.g., perimeter-side relationship for a square, distance-time graphs, and conversions such as feet to inches; use verbal descriptions, formulas or equations, tables, and graphs.

Solve equations

A.FO.06.11 Relate simple linear equations with integer coefficients to particular contexts, and solve, e.g., $3x = 8$ or $x + 5 = 10$.

A.FO.06.12 Understand that adding or subtracting the same number to both sides of an equation creates a new equation that has the same solution.

A.FO.06.13 Understand that multiplying or dividing both sides of an equation by the same non-zero number creates a new equation that has the same solutions.

A.FO.06.14 Solve equations of the form $ax + b = c$, e.g., $3x + 8 = 15$ by hand for positive integer coefficients less than 20, using calculators otherwise, and interpret the results.

MEASUREMENT

Convert within measurement systems

M.UN.06.01 Convert between basic units of measurement within a single measurement system, e.g., square inches to square feet.

Find volume and surface area

M.PS.06.02 Draw patterns (of faces) for a cube and rectangular prism that, when cut, will cover the solid exactly (nets).

M.TE.06.03 Compute the volume and surface area of cubes and rectangular prisms given the lengths of their sides using formulas.

GEOMETRY

Understand and apply basic properties

G.GS.06.01 Understand and apply basic properties of lines, angles, and triangles, including:

—triangle inequality

—relationships of vertical angles, complementary angles, supplementary angles

—congruence of corresponding and alternate interior angles when parallel lines are cut by a transversal, and that such congruencies imply parallel lines

—locate interior and exterior angles of any triangle, and use the property that an exterior angle of a triangle is equal to the sum of the remote (opposite) interior angles

—know that the sum of the exterior angles of a convex polygon is 360°.

Understand the concept of congruence and basic transformations

G.GS.06.02 Understand that for polygons, congruence means corresponding sides and angles have equal measures.

G.TR.06.03 Understand the basic rigid motions in the plane (reflections, rotations, translations), relate these to congruence, and apply them to solve problems.

G.TR.06.04 Understand and use simple compositions of basic rigid transformations, e.g., a translation followed by a reflection.

Construct geometric shapes

G.SR.06.05 Use paper folding to perform basic geometric constructions of perpendicular lines, midpoints of line segments and angle bisectors; justify informally.

DATA AND PROBABILITY

Understand the concept of probability and solve problems

D.PR.06.01 Express probabilities as fractions, decimals or percentages between 0 and 1; know that 0 probability means an event will not occur and that probability 1 means an event will occur.

D.PR.06.02 Compute probabilities of events from simple experiments with equally likely outcomes, e.g., tossing dice, flipping coins, spinning spinners, by listing all possibilities and finding the fraction that meets given conditions.